

Alexander McLeod Mathieson (1920–2011)

In the years immediately following World War II, Alexander ('Sandy') McLeod Mathieson pioneered X-ray crystallography in Australia. Sandy continued to make major contributions to the field over a 64-year time span and was widely recognized for his pioneering work in crystallographic methods, molecular structure determination and related instrument development. Ever an understated man, Sandy pursued science with vigour and passion, always preferring the laboratory to the limelight. He was universally admired and respected by his peers.

Born into a Presbyterian family in Aberdeen, Scotland, Sandy contracted poliomyelitis at the age of two. Owing largely to his mother's efforts, and despite prevailing medical opinion, he recovered sufficiently to walk with the aid of sticks and thrived at school – qualifying for a selective secondary school. His tertiary education continued at the Universities of Aberdeen (BSc Hons, 1942), to which he won a bursary, and Glasgow (PhD, 1948). His PhD research was carried out in structural crystallography at the University of Glasgow under Professor J. Monteath Robertson. In 1947, much to the surprise and concern of his parents, Sandy accepted a position in CSIR and came to Australia to work in the Section of Chemical Physics in the Division of Industrial Chemistry. At CSIR, with the benefit of the high-quality workshop capabilities developed during the Second World War, Sandy rapidly established an X-ray single-crystal diffraction laboratory that became a Mecca for budding crystallographers, with Sandy a strong mentoring influence for many young local scientists. These protégés included Harold Welch, Neville Stephenson, Hans Freeman, Jeff Wunderlich, Jack McConnell, John Taylor and Maureen Mackay, who in many cases went on to set up their own crystallography groups in institutions around Australia.

Sandy was an early exponent and contributor to crystal structure determination by direct methods. His work helped to allay the prevailing scepticism of the organic chemists by providing valuable examples demonstrating that, provided suitable crystalline derivatives could be prepared, such organic structures could be determined *ab initio* (i.e. using crystallographic data and the empirical formula). In one very notable instance, using X-ray crystallographic data (plus some chemical insight) he and Janis Fridrichsons pipped at the post a group of Swiss organic chemists who were using conventional analytical methods to try to determine the structure of lanostenol, a component of wool wax.

On the crystallographic methods and instrumentation side, Sandy was an early exponent of the 'heavy atom' method, e.g. using sulphur, iodine or bromine as heavy atoms, and made

important contributions to the determination of absolute structures. Sandy also made significant contributions to the development of instrumental techniques including, in the early days, the design of a linear diffractometer that arose from a single night's contemplation, the design of liquid N₂ cooling stages and a high-power generator. In later years, Sandy developed a polarization analysis device to study the microstructural properties of graphite with the aim of being able to better control beam properties for diffraction studies (before the availability of synchrotron sources). He also developed a range of other experimental methods aimed at the clean separation of sample and instrumental effects contributing to the distribution of intensity in Bragg reflections, and the elimination of extinction from structure factor measurements using extrapolation to the 'zero interaction' (extinction free) limit.

For his early contributions to X-ray instrument development, Sandy was appointed as a Member (1960–1972) (and as Chair from 1963) of the IUCr Commission on Crystallographic Apparatus. In this role, he ran a major 'round-robin' IUCr international collaboration on accuracy in single-crystal structure determination that led to an important series of papers in *Acta Crystallographica* Section A. He was a Member of the Commission on Structure Reports (1961–1972). From 1969 to 1975, Sandy served on the IUCr Executive. As a reflection of his scientific standing, Sandy was elected a Fellow of the Australian Academy of Science in 1967, and a member of the Academy Council from 1975 to 1978.

Among Sandy's closest scientific collaborators and/or group members at various times in CSIRO were Janis Fridrichsons, Barrie Dawson, Benno Schoenborn, Dai Davies, Jeff Wunderlich, Andrew Hurley, Tony Beecham, Jock Mackenzie,



Figure 1
Alexander ('Sandy') McLeod Mathieson, FAA (1920–2011).

Victor Maslen, Bruce Poppleton, Charlie Kowala, Bill Denne, Sylvia Mair, Steve Wilkins, Barbara Moss and Andrew Stevenson. Some of his international collaborators at various times were Uli Arndt, Reg Killean, Larry Calvert and Jim Lawrence.

Sandy never lost his thirst for knowledge and understanding. He thought deeply about science and pursued his chosen scientific objectives with a steely determination. This included a love of discussing scientific objectives with colleagues and engaging them in each new pursuit. His heroes in latter times were W. H. Bragg and Charles Galton Darwin (grandson of the author of *'Origin of Species'*), a pioneer in the theory of X-ray scattering from real crystals. Even in his last few years, Sandy was thinking deeply about fundamental problems in crystallography, particularly 'extinction', and seeking to make further advances.

From 1965 to 1985, Sandy was a Chief Research Scientist in CSIRO and leader of the X-ray Diffraction section. During this time he served as Acting Chief of the Division of Chemical Physics (1978–1980). Among the various awards and degrees that he received for his work during his career were the David Syme Medal from the University of Melbourne (1954), the Royal Australian Chemical Institute's Smith Medal (1963), a DSc from the University of Melbourne (1956) and an Honorary DSc from the University of St Andrews (1989). He was awarded a Centenary Medal in 2003. In the area of scientific conferences, Sandy was responsible for chairing the organizing committees of two international meetings, namely the 1968 IUCr 'Accurate Determination of X-ray Intensities and Structure Factors' meeting in Cambridge, UK, and the 1974 IUCr/AAS 'Diffraction Studies of Real Crystals and Real Atoms' in Melbourne.

On his retirement from CSIRO in 1985, Sandy was appointed Honorary Professor of Chemistry at La Trobe University, where his colleagues Jim Morrison and former postgraduate student Maureen Mackay had positions. Generous with his expansive knowledge and scientific passion acquired over a remarkable career, Sandy was able to continue working there for close to 20 years, during which time he felt he continued to make significant contributions to X-ray science. As at CSIRO, he continued to encourage blossoming scientists at an early stage of their careers. Sandy led a full life, travelling widely to conferences and scientific meetings. In honour of his seminal contributions to X-ray crystallography in Australia and his profound influence in shaping the field, the Society of Crystallographers in Australia and New Zealand (known in early days as 'The Bush Crystallographers') decided three years ago to name its biennial award for outstanding scientific achievement by a young scientist based in Australia or New Zealand 'The Sandy Mathieson Medal', the first award of which is scheduled for the AsCA12/CRYSTAL28 meeting in Adelaide in December 2012. This is one among many ways that the memory of Sandy Mathieson will endure. Sandy died peacefully in Melbourne on 30 August 2011 and is survived by his wife of 58 years Lois (nee Hulme), daughters Fiona and Sheena, and their families.

Stephen Wilkins and Andrew Stevenson

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